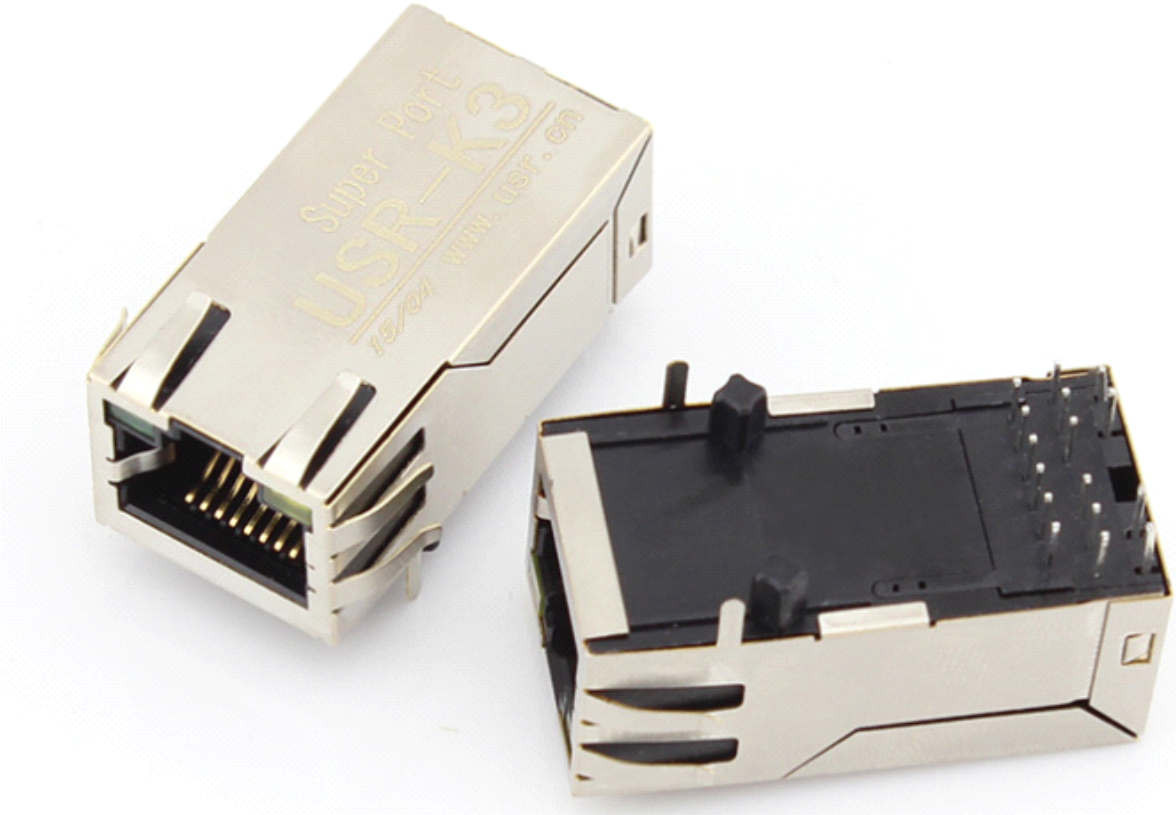
Multifunctional Serial to Ethernet converter(Super Port)

(USR-K3)

File version: V1.0.7



Jinan USR IOT Technology Co., Ltd. works on LAN and WAN and wireless for MCU to Ethernet Solutions, Ethernet, WIFI, GPRS, and Wireless modules, we can supply custom design for those usage, looking forward to cooperate with you.

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1. Introduction

1.1. Overview

The USR-K3 product series is an small package, intelligent plug-and-play UART to Ethernet adapter. K3 enables any device or machine with a serial port(UART), to become Ethernet network and Internet enabled, and have network data transmit ability. It features a powerful built-in device server, so you can access your serial device from anywhere in the world over internet! The USR-K3 is easily configured via local network, or through the serial port and web pages.

We Provide Network products and the best service to our customers.
• Chips • Modules • Software • Products

1.2 Features

1. New Cortex-M4 kernel, industrial working temperature range(-40~85℃), elaborate optimization TCPIP protocol stack, stable and reliable.
2. Auto-MIDX function, discretionarily connect cross-over or direct network cable, automatic switching.
3. Support TCP Server, TCP Client, UDP, UDP Server, HTTPD Client,websocket, various of ethernet protocols.
4. Support virtual serial port, provide corresponding software.
5. Serial port highest baud rate from 600bps to 1024Kbps.
6. Single DC3.3V supply.
7. Support DHCP. User can find the device within LAN network through the UDP broadcast protocol(using software USR-TCP232-M4 Setup).
8. Provide PC TCP/IP SOCKET programming example, VB, C++, Delphi, Android, IOS.
9. A built-in web page, also parameter setting via web, can customize web pages for users.
10. Can also set parameters via UDP broadcast, provide the set up protocol.
11. RJ45 status indicator light, RJ45 interface built-in isolation transformer, 2 KV isolation.
12. The global unique MAC address bought from IEEE, the user can also use their own mac(please state when you make order).
13. Support upgrade firmware via network.
14. Support visit IP and domain name at the same time
15. Support up to 8 link from client when act as TCP Server, same data will be send to all client.

16. Can modify http server port from default port 80 for module built-in http server.
17. Support Keepalive, detect a dead link quickly and make connection more stable.

1.2. Applications

- Fire and Security Panels
- Vending Machines
- Point of Sale Terminals
- Remote equipment management
- IT management services
- Access Control
- Industrial Control
- Home Automation
- Instrumentation
- Building Control
- Power Management

1.3. Order information

Type	Part Numbers	Electric interface
Super Port	USR-K3	1*UART, built-in RJ45

Diagram 1-1 Order information

- Config method: comm port/network/webpage
- Power supply: DC3.3V only
- Inches: 33.02 x 19.01 x 19.15 (mm, include the Shrapnel)
- Work temperature: -40~+85°C
- Store temperature: -40~85°C，5~95%RH
- Buffer of comm port: 2K byte
- Buffer of Network: 16K byte

1.4. Electrical characteristics

All the data is get at tempture 25℃, network cable plug in, max data transmittion(10ms, 20 byte, sending data constantly).

	Input Voltage range	Current cosumption at 3.3V
USR-K3	DC3.3V	120mA(115-125)

2. Module Test

If you have any question, please contact us the in the client support center:

http://h.usriot.com/index.php?c=frontTicket&m=sign

2.1. Hardware connection

The picture below is a serial device server of USR-K3. It have 1 UART to ethernet interafce.

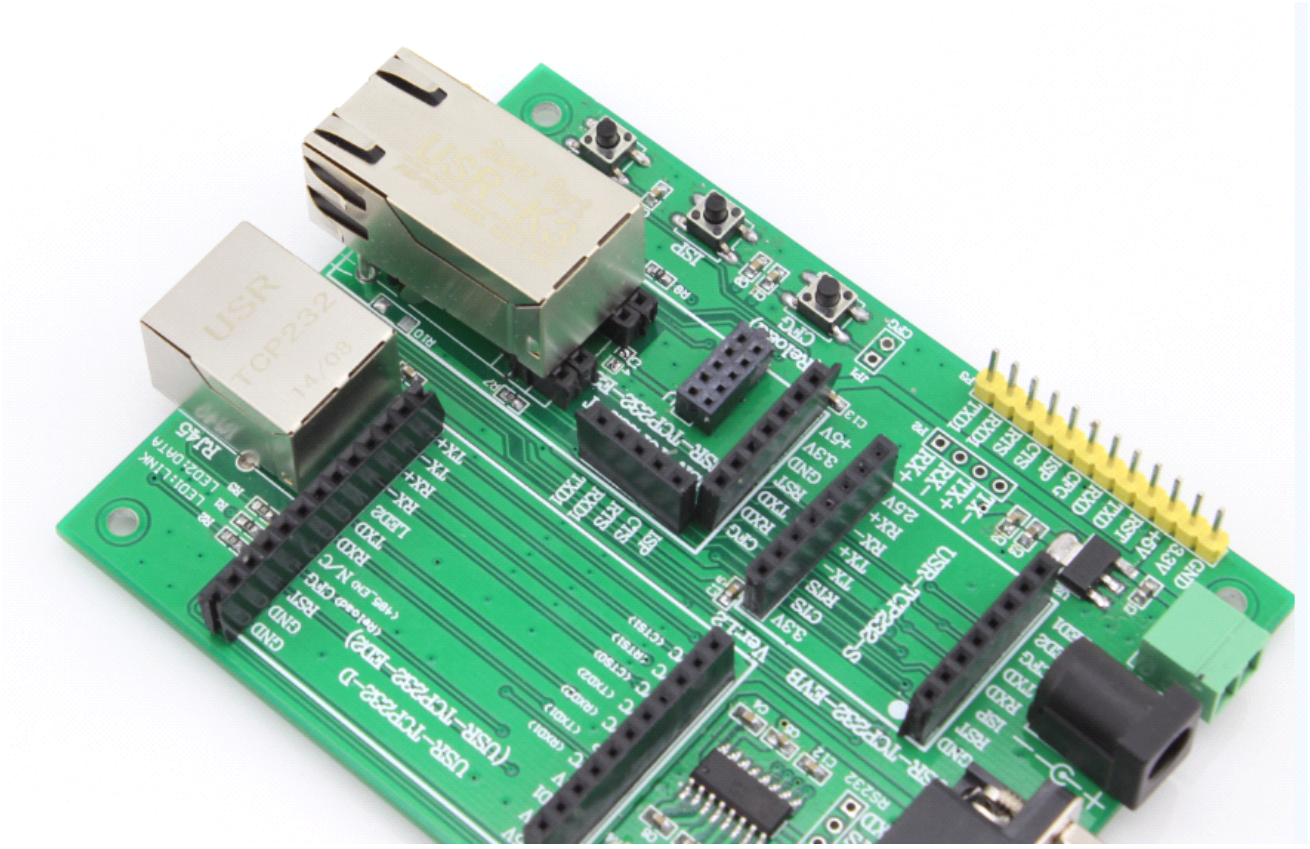


Diagram 2-1 TCP232-410 with case

Power the eval board with DC5V adaptor(make sure you can supply at least 200mA current at DC5V, USR-K3 only accept DC3.3V, but since we are using a eval board, DC5V will do)

Connect K3's RJ45 to PC directly with network cable(No need to distinguish cross or direct connect cable), or connect the module and PC via switch or router and set the PC's ip address to 192.168.0.201(must be a format of 192.168.0.xxx), netmask 255.255.255.0.

Connect eval board's RS232 and PC's comm port together, with a standard male-female extend cable(default no-cross-over cable).

Here is USR-K3's default net configuration,

IP address: 192.168.0.7

Subnet mask: 255.255.255.0

The default gateway: 192.168.0.1

2.2. Login

Open a browser, type and Login above IP address http://192.168.0.7, you will enter module's setup web pages. There will be a windows login verify dialog.

User name and password are both “admin”, this can be modified after login into the system.

Default user name: admin

Default password: admin

After you login, you can see webpage as follow,

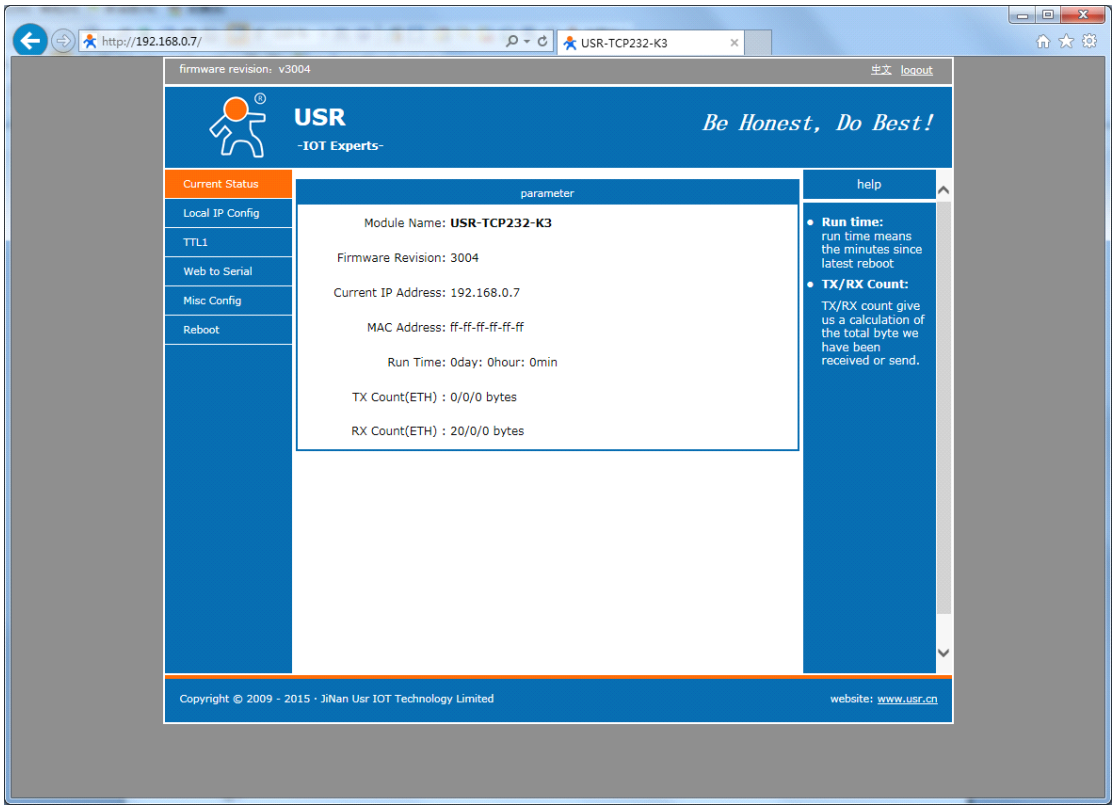
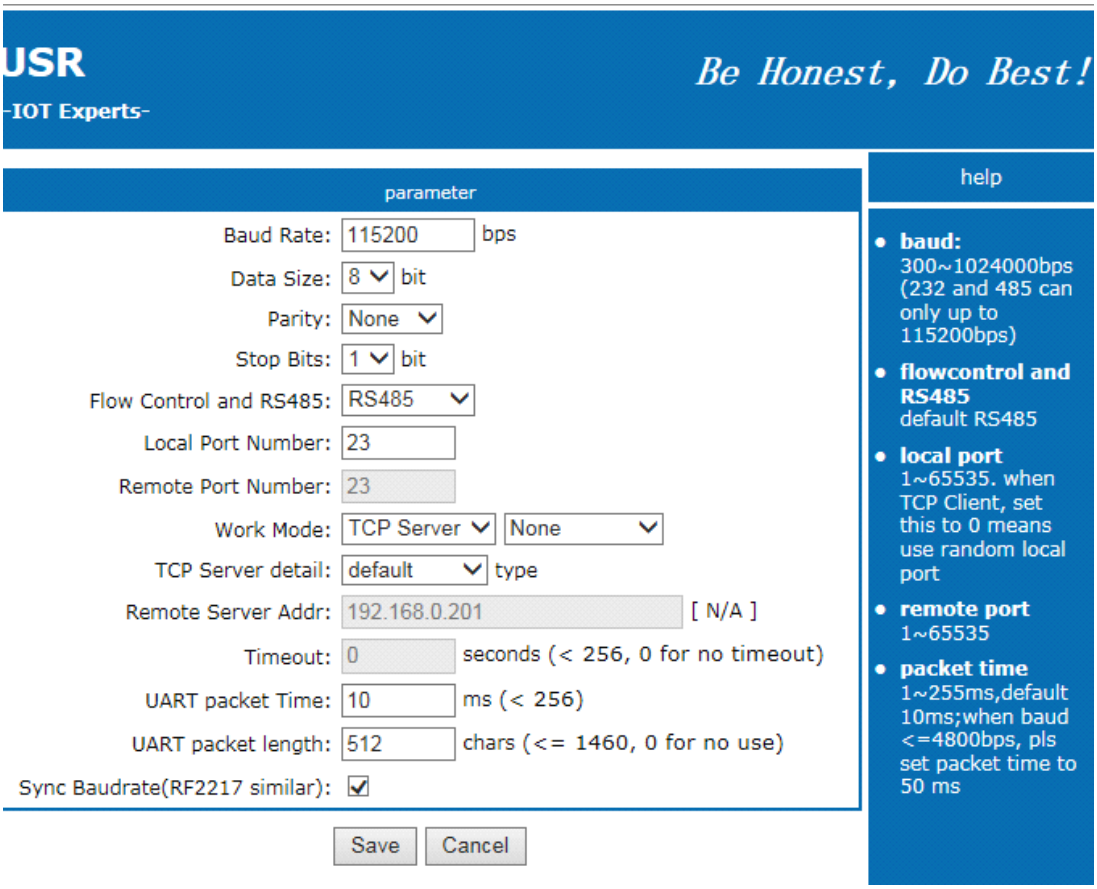


Diagram 2-2 webpage after login

- Current Status: the module's name, current ip, firmware revision, and other status infomation
- Local IP Config: the module's ip address, submask and gateway parameter
- TTL1: the module's serial to ethernet parameter
- Web to Serial: web to serial data transparent
- Misc Config: some parameter such as user name and password parameter
- Reboot: user can reboot/restart module from here


USR
-IOT Experts-
Be Honest, Do Best!
parameter
Baud Rate: 115200 bps
Data Size: 8 bit
Parity: None
Stop Bits: 1 bit
Flow Control and RS485: RS485
Local Port Number: 23
Remote Port Number: 23
Work Mode: TCP Server None
TCP Server detail: default type
Remote Server Addr: 192.168.0.201 [N/A]
Timeout: 0 seconds (< 256, 0 for no timeout)
UART packet Time: 10 ms (< 256)
UART packet length: 512 chars (<= 1460, 0 for no use)
Sync Baudrate(RF2217 similar):
Save
Cancel
help
baud: 300~1024000bps (232 and 485 can only up to 115200bps)
flowcontrol and RS485 default RS485
local port 1~65535. when TCP Client, set this to 0 means use random local port
remote port 1~65535
packet time 1~255ms,default 10ms;when baud <=4800bps, pls set packet time to 50 ms

2.3. Default parameter test

To test briefly in default working mode, on the foundation of the hardware connection, use the matched software USR-TCP232-Test to make transmitting and receiving test. The left side is serial port, use software default settings, the right side is the network part, set to TCP Client and server to be IP 192.168.0.7, port 23.

By default, the two COM port to be set as TCP Server mode, port is 23.

This illustration shows the 10 ms two-way simultaneous automatically transmit screenshots. As the allocated memory of the display control is limited, in order to test large amount of data transceiver, here will suspend the receive display, only statistical data. Below is the effect after testing for a few hours, and transmitting millions of bytes. Stable and reliable, without a byte loss.

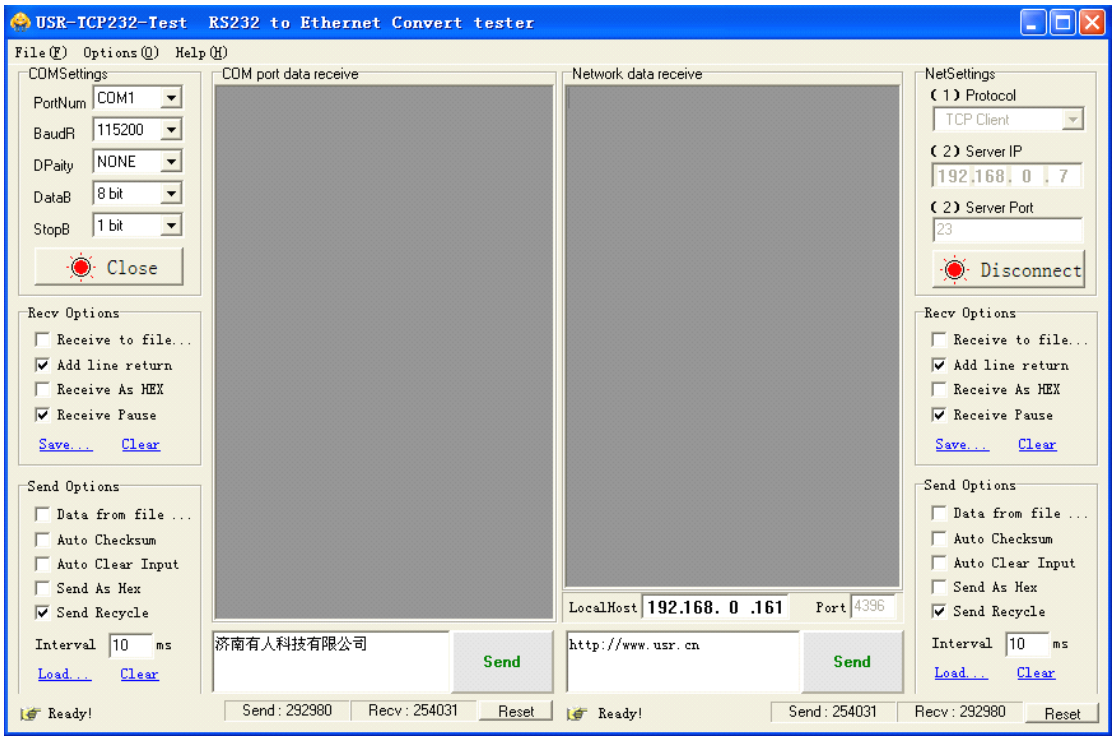


Diagram 2-3 default working mode communication

3. Work mode

3.1. UDP mode

When in UDP mode, after power on, module listen on specific port.

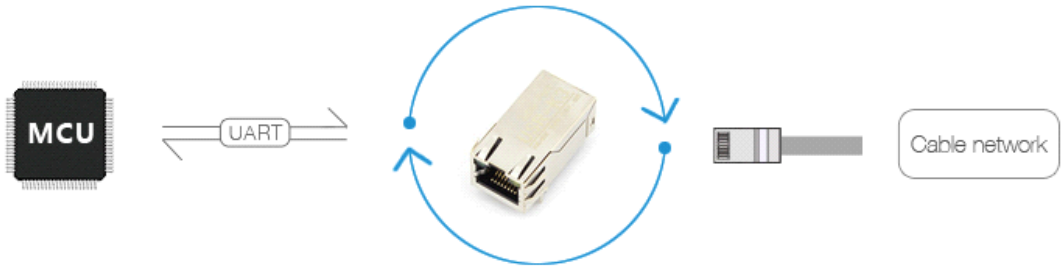


Diagram 3-1 UDP mode

When received data from this udp port, send it to serial port;otherwise, when data is received from serial port, send it to ethernet.

The assist software can be download from link below:

http://www.usriot.com/Download/199.html

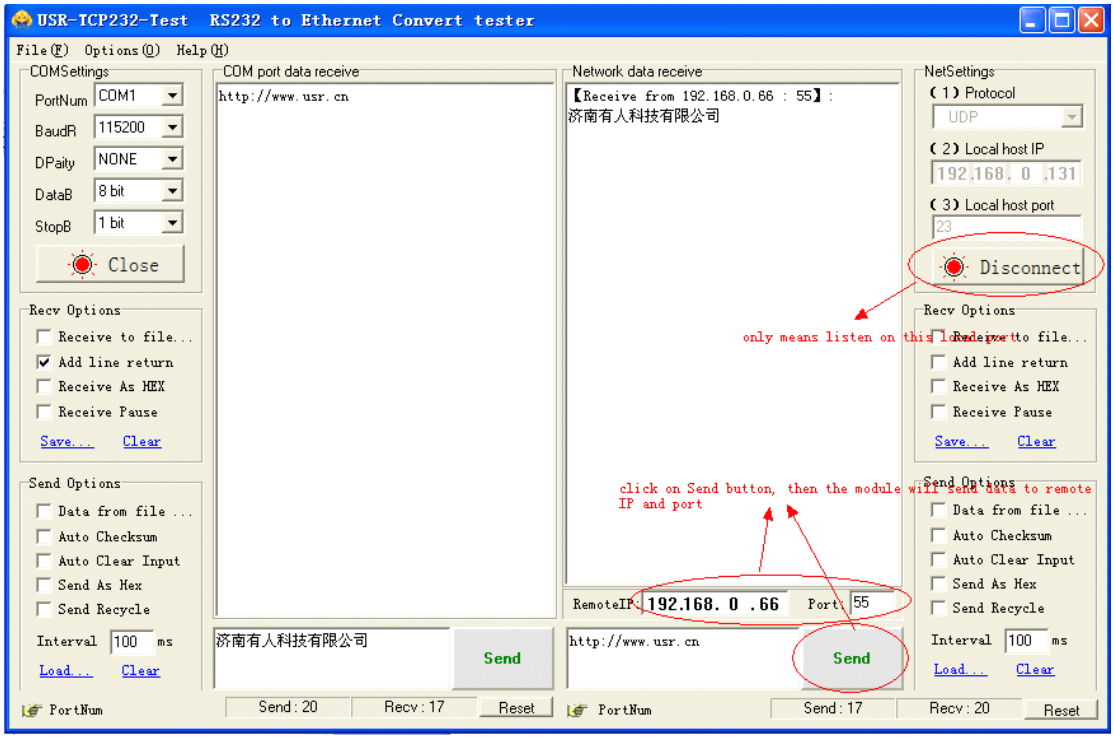


Diagram 3-2 UDP mode communication test

Note:

1) local port and remote port can be different.

2) Max UDP send length(ethernet to serial) is 1472 bytes. If you want to send more than 1472 Bytes, please div it into shorter packet.

3.2. TCP Client mode

Open web pages and config module to

Telent Mode: TCP Client

Remote port number: 23

Telnet Server Addr: 192.168.0.131

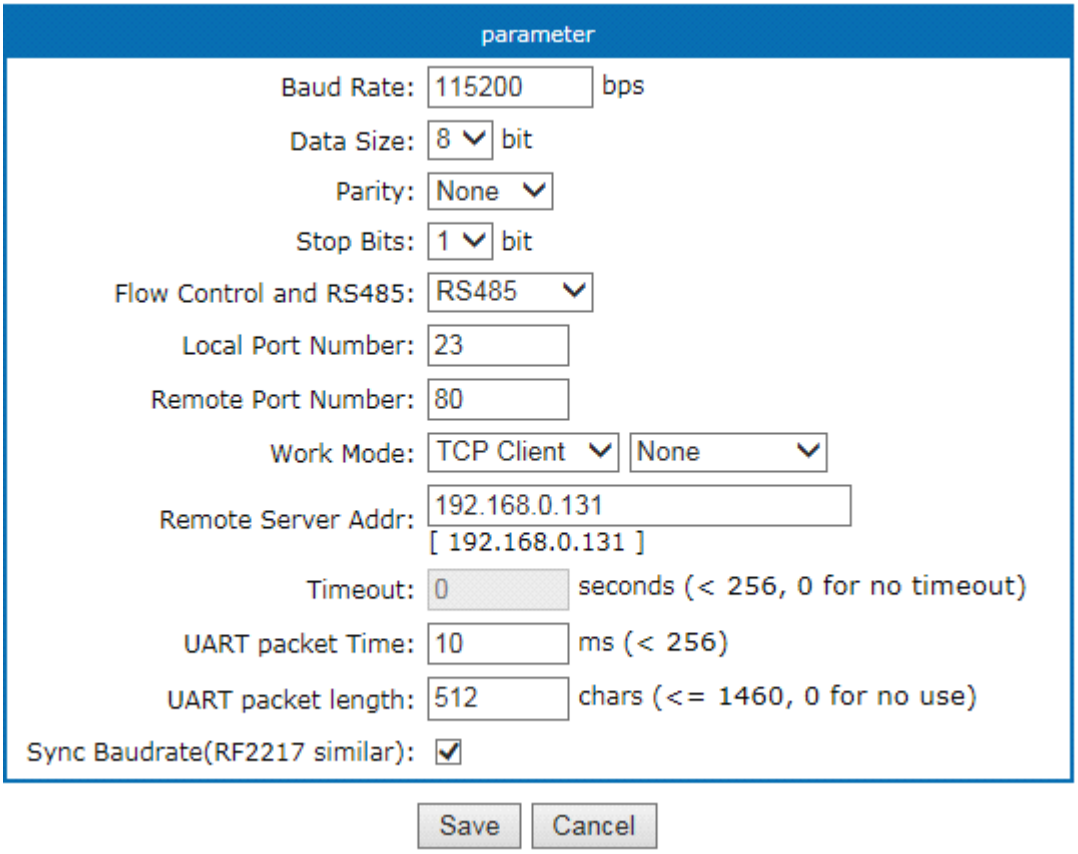

parameter
Baud Rate: 115200 bps
Data Size: 8 bit
Parity: None
Stop Bits: 1 bit
Flow Control and RS485: RS485
Local Port Number: 23
Remote Port Number: 80
Work Mode: TCP Client None
Remote Server Addr: 192.168.0.131
[192.168.0.131]
Timeout: 0 seconds (< 256, 0 for no timeout)
UART packet Time: 10 ms (< 256)
UART packet length: 512 chars (<= 1460, 0 for no use)
Sync Baudrate(RF2217 similar):
Save
Cancel

Diagram 3-3 TCP Client mode

Use USR-TCP232-Test,

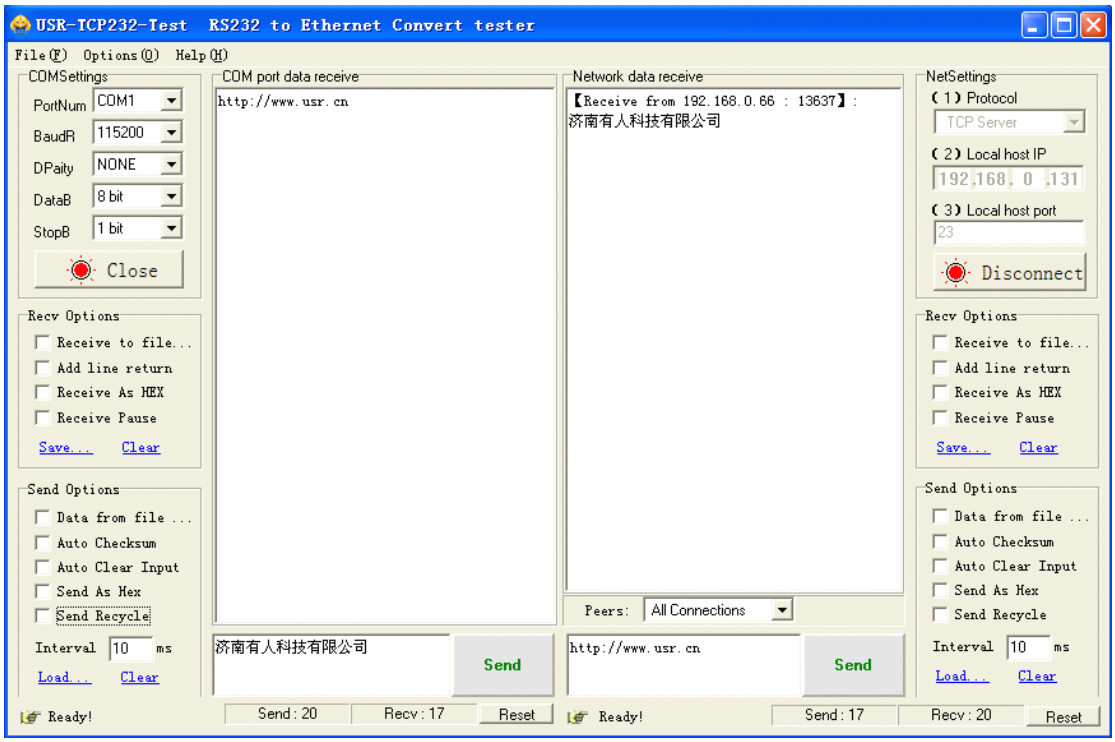


Diagram 3-4 TCP Client communication test

3.3. UDP Server mode

Like the socket UDP server in pc API. Many to one data transfer supported, the data from uart part will be transformed to the last UDP packet's address.

Here show 2 UDP client communicate with server, server send data to the last client communicates with it.

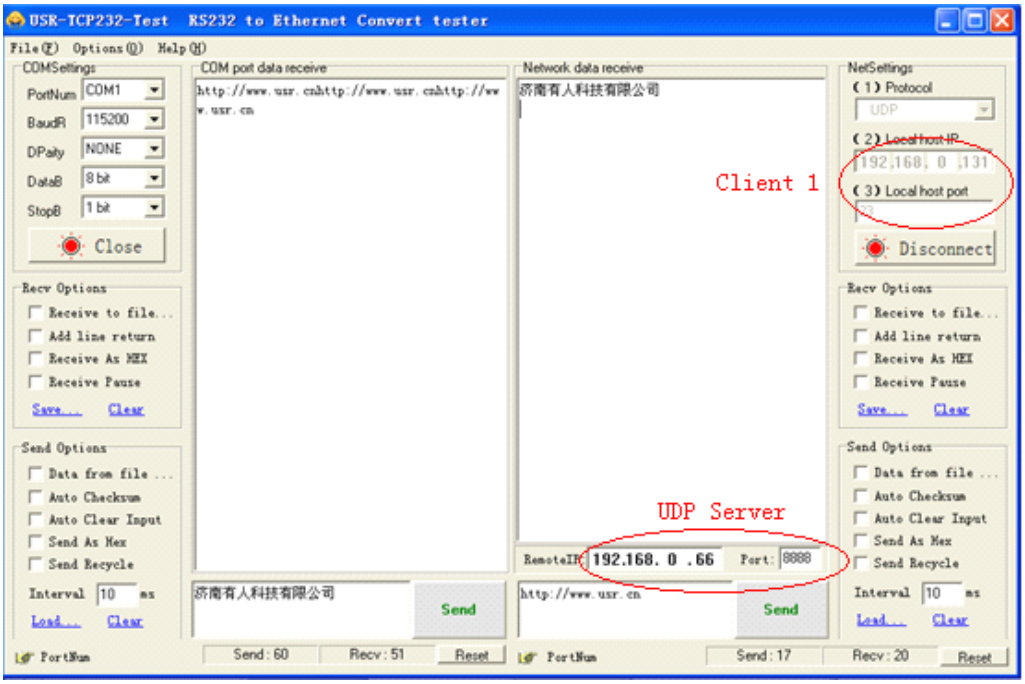


Diagram 3-5 Client 1 <-> server

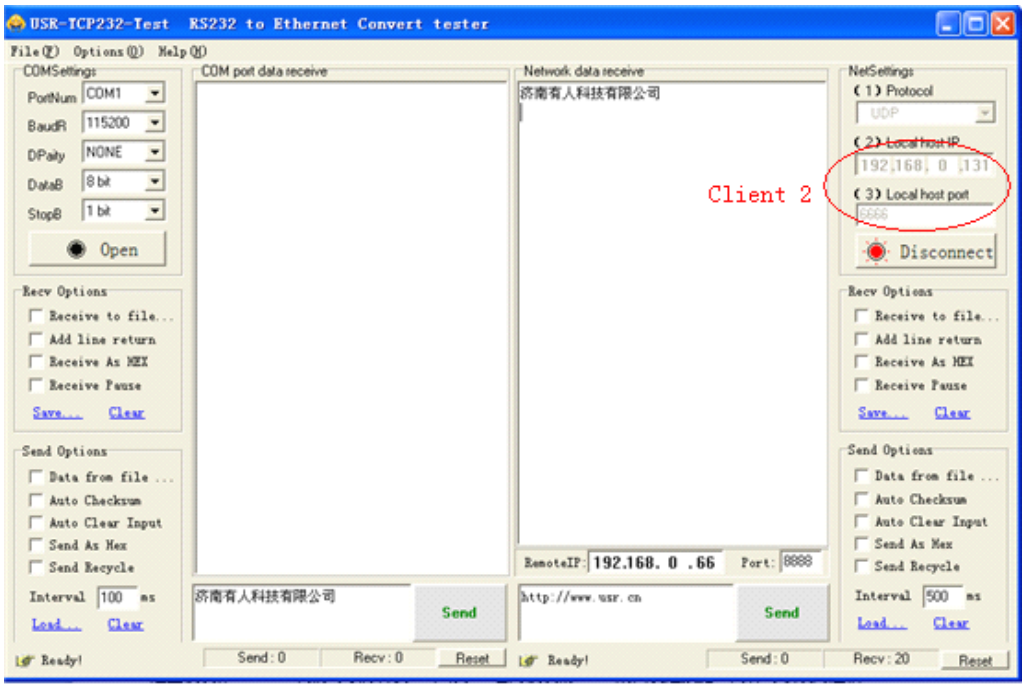


Diagram 3-6 Client 2 <-> server

3.4. TCP Server mode

TCP Server mode have 2 parameters: max link number and link type

1. max link number: 1 ~ 8;

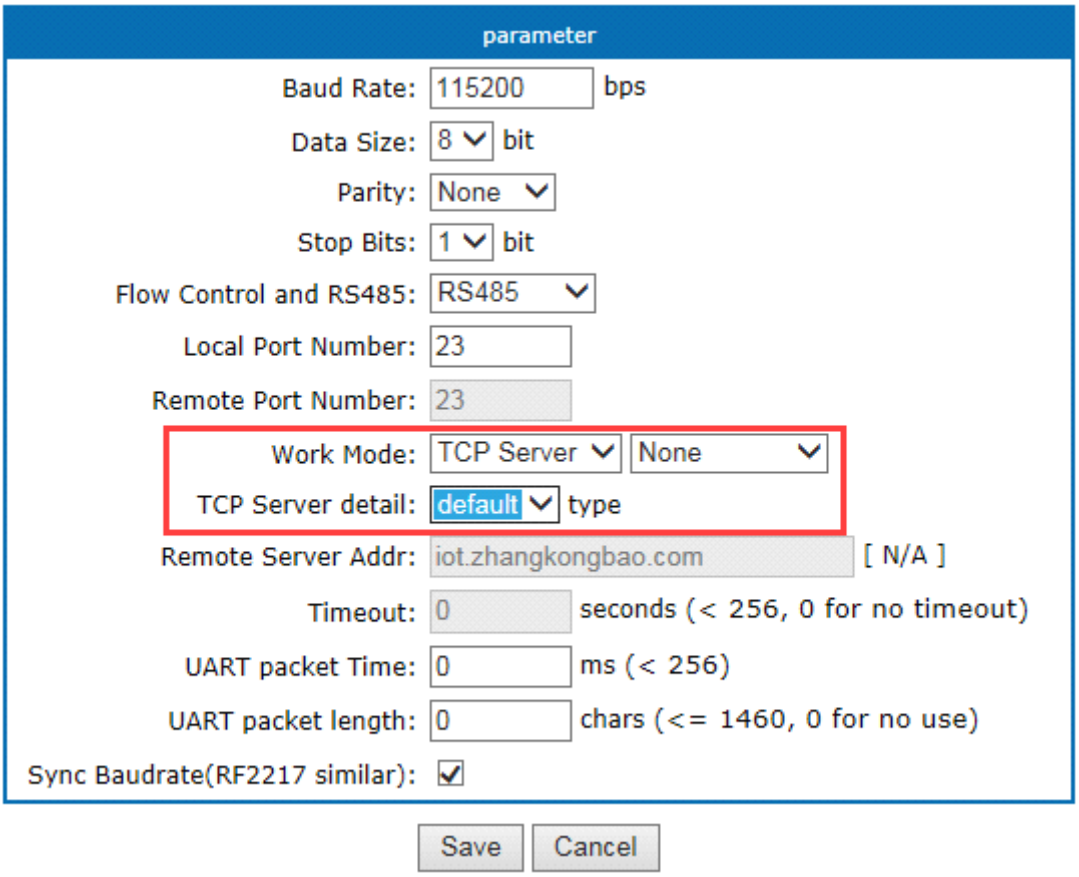

parameter
Baud Rate: 115200 bps
Data Size: 8 bit
Parity: None
Stop Bits: 1 bit
Flow Control and RS485: RS485
Local Port Number: 23
Remote Port Number: 23
Work Mode: TCP Server None
TCP Server detail: default type
Remote Server Addr: iot.zhangkongbao.com [N/A]
Timeout: 0 seconds (< 256, 0 for no timeout)
UART packet Time: 0 ms (< 256)
UART packet length: 0 chars (<= 1460, 0 for no use)
Sync Baudrate(RF2217 similar):
Save
Cancel

Diagram 3-7 web page configuration

3.5. Httpd Client mode

This function is easier used for web page developer. We establish one web server page, add this:

[<?php echo $_GET['data']; ?>]

Means we can GET data from HTTP client's request. Open this URL: www.usr.cn/1.php?data=12345, the web page is downbelow, we can see that the web server have got the data(12345),

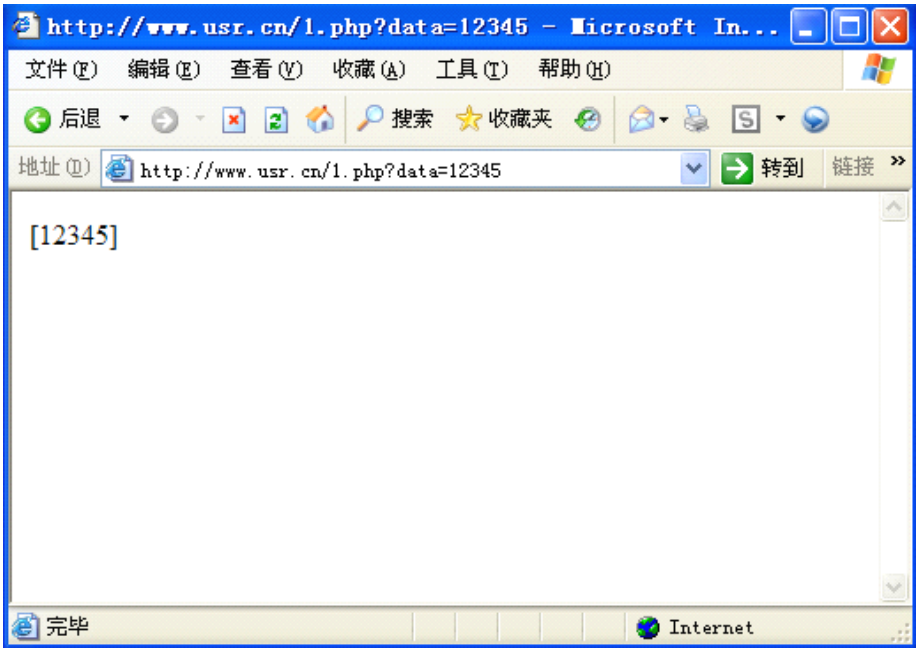


Diagram 3-8 Request **www.usr.cn/1.php?** and upload data

Then we take another way, set USR-K3 module Work mode HTTPD Client, Target address **www.usr.cn,** remote port 80.

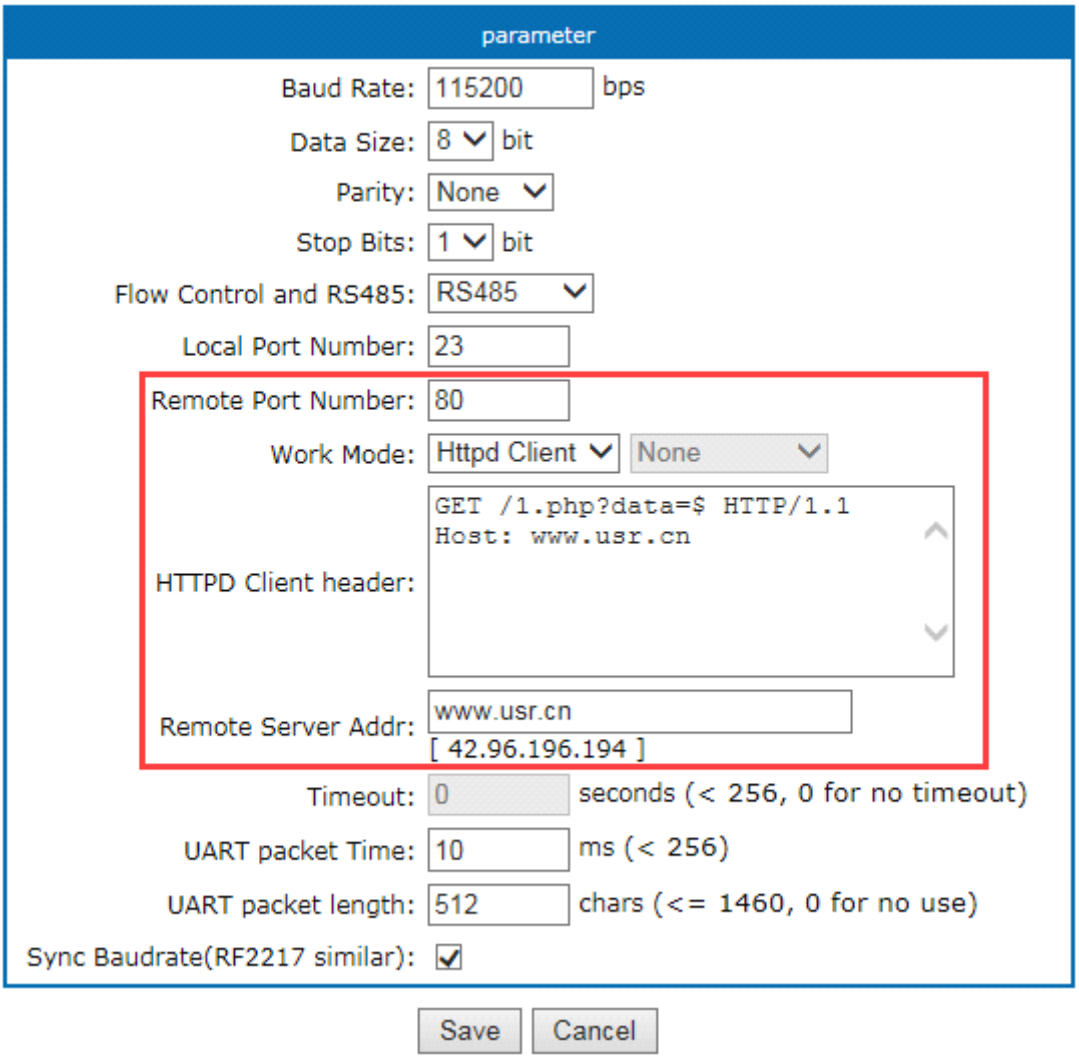

parameter
Baud Rate: 115200 bps
Data Size: 8 bit
Parity: None
Stop Bits: 1 bit
Flow Control and RS485: RS485
Local Port Number: 23
Remote Port Number: 80
Work Mode: Httpd Client None
HTTPD Client header:
GET /1.php?data=$ HTTP/1.1
Host: www.usr.cn
Remote Server Addr: www.usr.cn
[42.96.196.194]
Timeout: 0 seconds (< 256, 0 for no timeout)
UART packet Time: 10 ms (< 256)
UART packet length: 512 chars (<= 1460, 0 for no use)
Sync Baudrate(RF2217 similar):
Save
Cancel

Diagram 3-9 config HTTPD Client

Open USR-TCP232-Test, and type in a string such as "12345", then send via comm port to USR-K3, and see the response from **www.usr.cn** .

Diagram 3-10 module act as HTTPD Client

In the response, all the data returned, but the http header from server will be returned, too. the user may need to parse this to get your data.

4. Hardware

About the new PCB libraries file, we can download it from website **http://www.usriot.com/Download/221.html** .

4.1. Hardware

Diagram 4-1 USR-K3

- Mechanical dimesion: 33.02 x 19.01 x 19.15 (mm, include the Shrapnel)
- 3.3V power input
- 1 * UART (TTL, 3.3V)
- support hardware flow control(RTS/CTS)

4.2. Pin definition

Power supply socket, The input voltage range only DC 3.3V, average current 120 MA.

if your MCU's signal is 5V, pls add a signal convert between 3.3V and 5V

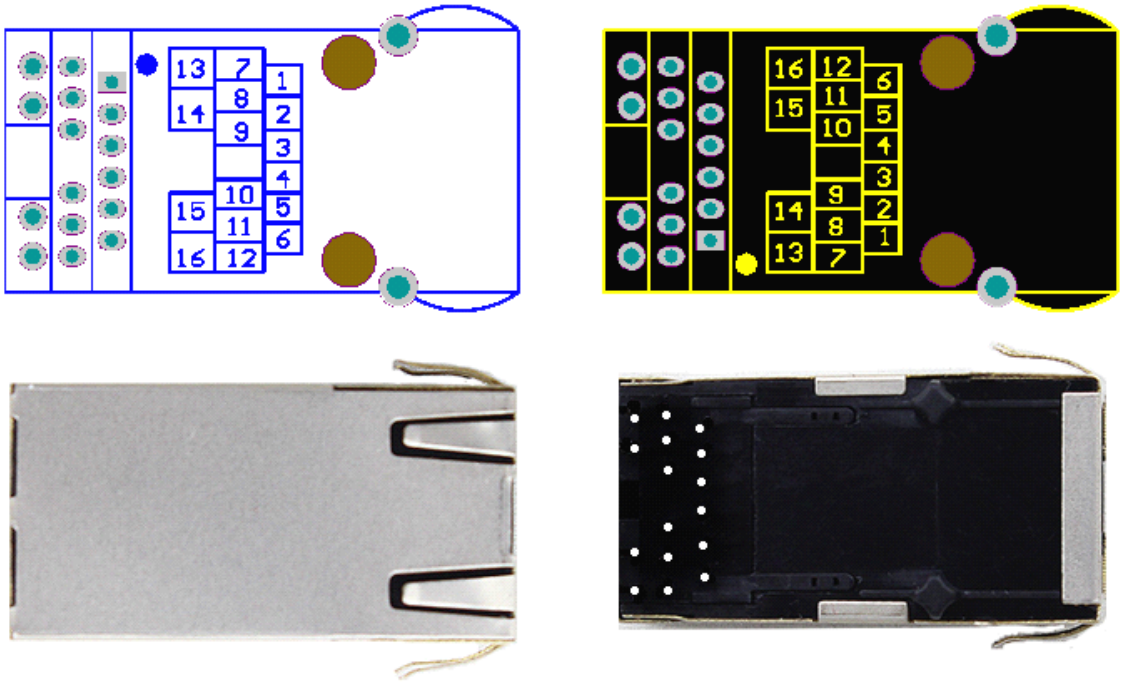


Diagram 4-2 pin diagram of K3(left for top view, right for bottom view)

id	name	description
1	NC	Unused, pls leave it to float
2	NC	Unused, pls leave it to float
3	CTS	Clear to send
4	RST	Reset pin(give a constant 200ms low level make module reset)
5	RTS	Request to send(also muxed as RS485 enable tx pin, enable it from software in)
6	Reload	Unused, pls leave it to float
7	LED2	LED2, pls connect this pin to another LED2
8	RXD	Data receive pin for comm port
9	TXD	Data transmit pin for comm port
10	GND	ground
11	3V3	DC3.3V(you must choose only one supply between 5V or 3.3V)
12	LED1	LED1, pls connect this pin to another LED1
13	LED2	LED2, pls connect this pin to another LED2
14	LED_3V3	Power input for LED, pls connect this pin to another

		LED_3V3
15	LED_3V3	Power input for LED, pls connect this pin to another LED_3V3
16	LED1	LED1, pls connect this pin to another LED1

Diagram 4-3 Pin definition

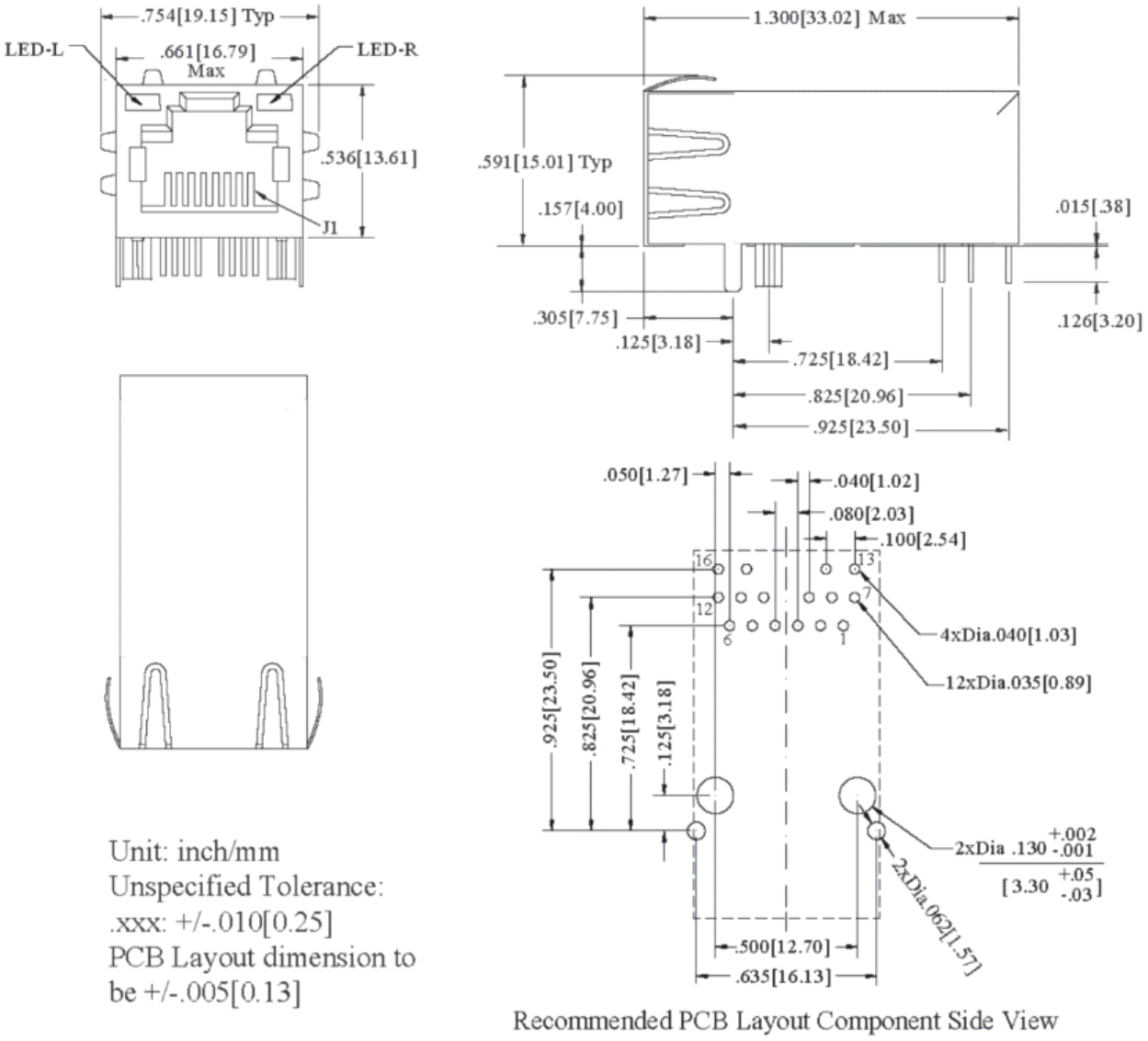


Diagram 4-4 inches

4.3. Connection diagram

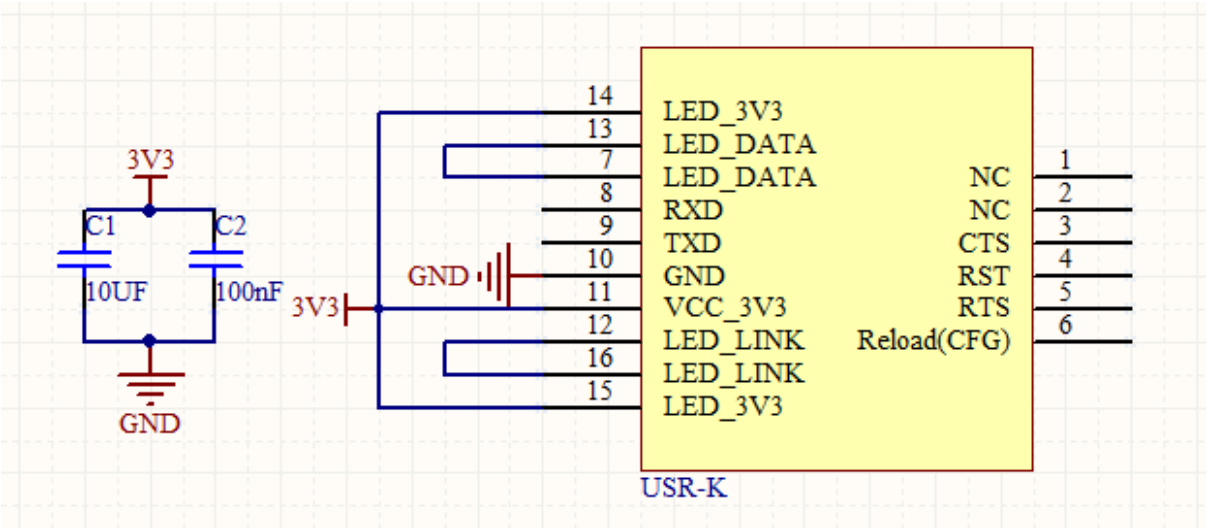


Diagram 4-5 connection diagram

This is connection diagram for USR-K3 when user design their product with K3, there is a few points we need to attend to

- Power K3 with a stable 3.3V
- Connect 2 LED_3V3 together
- Connect 2 LED_DATA together
- Connect 2 LED_LINK together
- Connect RXD, TXD with user's MCU
- Leave the unused pin to a float state

4.4. LED

ID	name	Description
2	Link(green)	On RJ45, when ethernet physical link established, on.
3	Data(yellow)	On RJ45, wnen ethernet data communicate, toggle.

Diagram 4-6 LED definition

4.5. RJ45 interface

module network interface is 10 M / 100 M adaptive, support AUTO - MDIX, can discretionarily connect cross-over or direct network cable. That is to say, you can use either kind of cable to connect with computer or other network decice .

5. Paramters configuration

5.1. Web page

Usually, this module is configured through web pages.

5.2. network command(setup software)

1. through software USR-TCP232-E45 Setup V1.0.5.0;
2. Network command(need to ask for protocol).

Down below is the Setup, **http://www.usriot.com/Download/90.html**

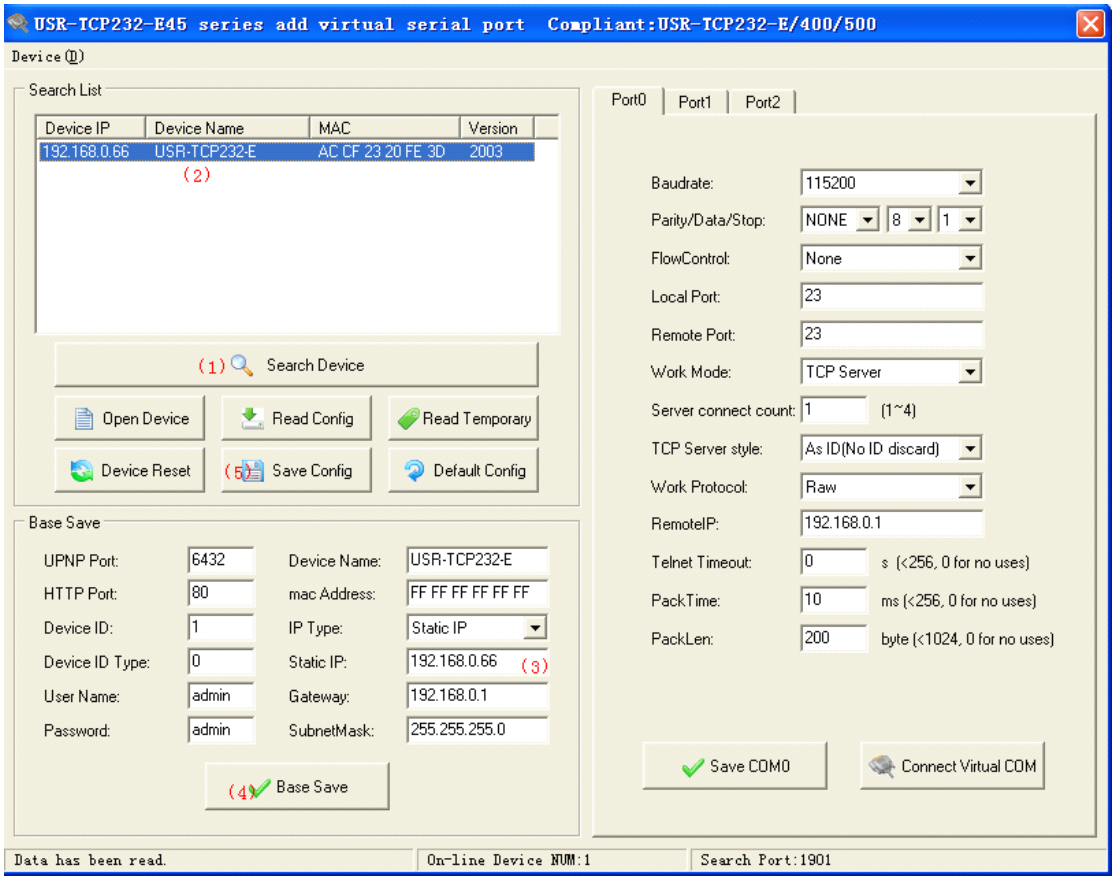


Diagram 5-1 Setup software

(1)click ‘Search Device’;

(2)Select device in search list;

(3)Modified paramters such as static ip;

(4)Click ‘Base Save’, paramters will be saved;

(5)Click ‘Save Config’, the paramters will take effect;

(6)Search again, module will appear in new paramters.

Note.

After modified paramters, need first ‘Base Save’ or ‘Save COMx’, then ‘Save Config’. If not, the paramters will only be saved, but not take effect.

6. Specific functions

6.1. ModbusRTU to ModbusTCP

The whole series product support ModbusRTU to ModbusTCP. When you use it, you have to select the protocols, just here:

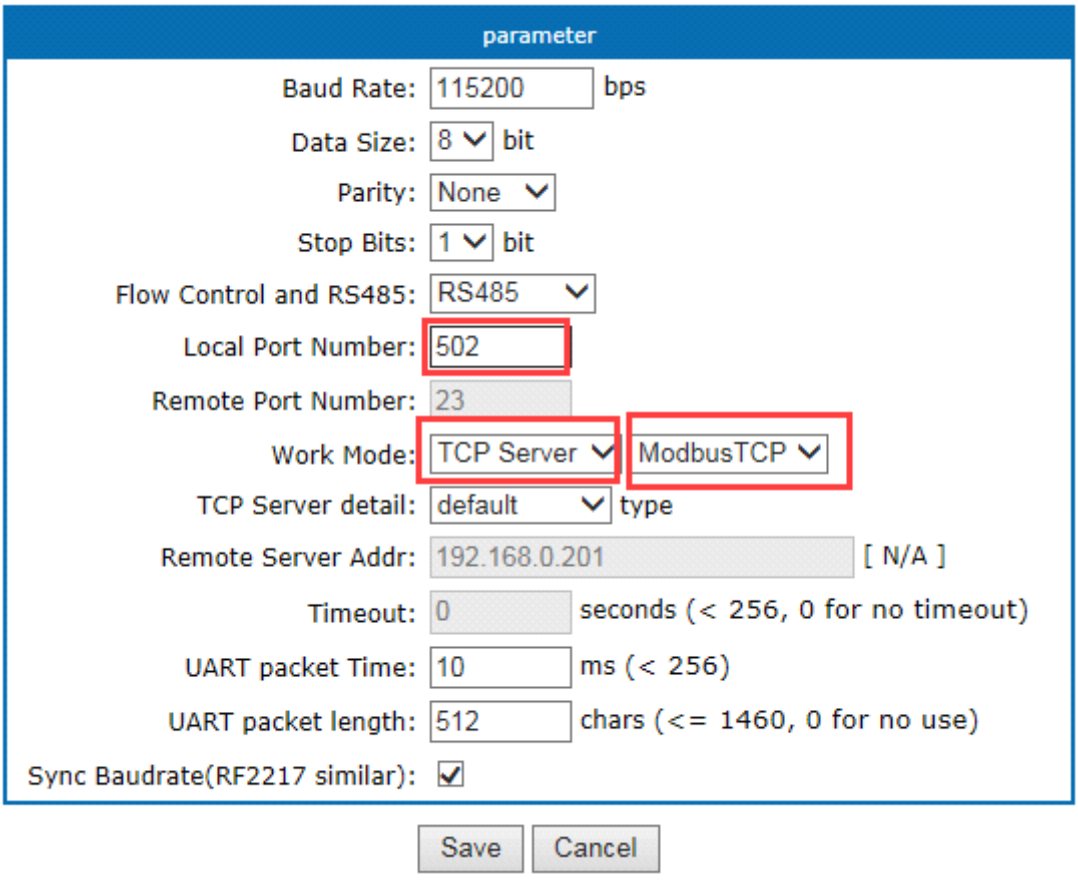

parameter
Baud Rate: 115200 bps
Data Size: 8 bit
Parity: None
Stop Bits: 1 bit
Flow Control and RS485: RS485
Local Port Number: 502
Remote Port Number: 23
Work Mode: TCP Server ModbusTCP
TCP Server detail: default type
Remote Server Addr: 192.168.0.201 [N/A]
Timeout: 0 seconds (< 256, 0 for no timeout)
UART packet Time: 10 ms (< 256)
UART packet length: 512 chars (<= 1460, 0 for no use)
Sync Baudrate(RF2217 similar):
Save
Cancel

Diagram 6-1 choose ModbusTCP on webpage

Here, the usement and function is presented below.

- Selection None, that indicate we are using a standard Transparent mode, no protocol convertion.
- Selection ModbusTCP, means we use protocol convertion from Modbus RTU to ModbusTCP.
- In the comm side(RS232 or RS485), it's ModbusRTU protocol , the ethernet side is ModbusTCP.

- The ethernet side must be a Master, who send query frame first, and the Modbus RTU device respond with data to the command.

The function acts as below.

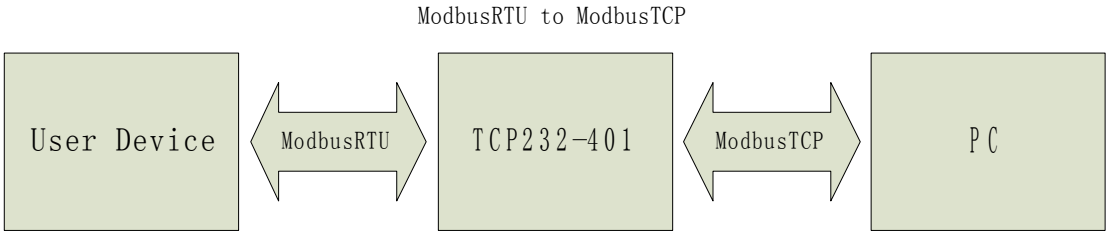


Diagram 6-2 function description for ModbusTCP to modbus RTU

6.2. Hardware flow control(RTS/CTS)

If you want to use Hardware flow control, select it before using.

RS232 interface support hardware flowcontrol（RTS/CTS）

Pin name	Description	IO type	Operater
RTS	Request to Send	O	module
CTS	Clear to Send	I	Outside device(PC)

Diagram 6-3 Pin description

When RTS = 0, enable the other side to send, at this time, TTL is 0 volt, RS232 is -3V ~ -15V;

When CTS = 0, represent module is enabled to send, at this time, TTL is 0 volt, and RS232 is -3V ~ -15V;

When the logic is reverse, represent that disable the other side to send or was disabled the module to send.

When connect with PC's RS232 interface, we can use the serial cable(cross).

6.3. MAC address

In Current status page, we can see the currently MAC address in use. Diagram below is using the factory MAC.

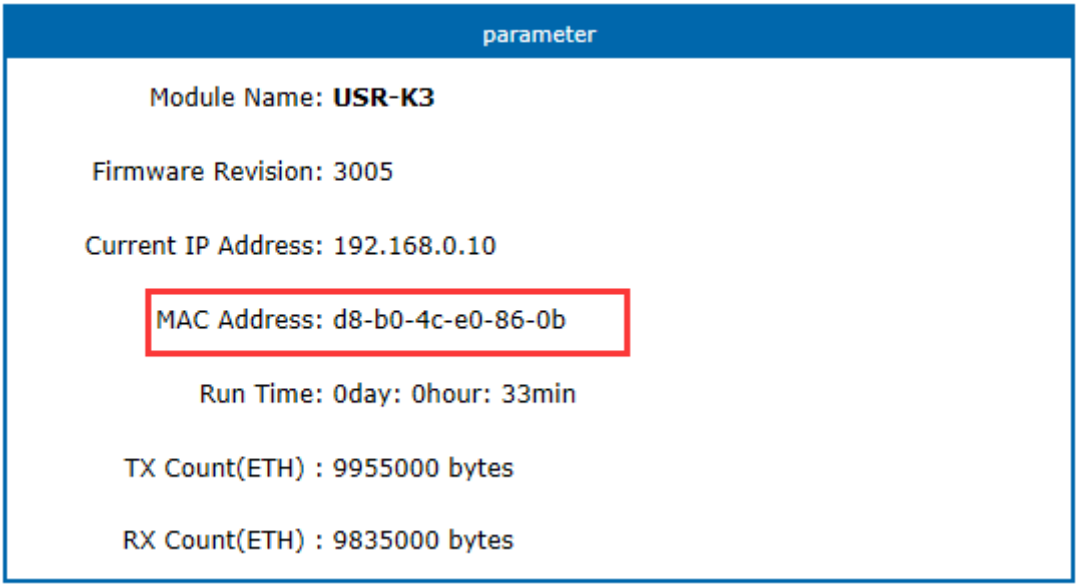


Diagram 6-4 currently MAC in use

6.4. Packet time and Packet length

If packet time is 10ms, packet length 512 byte. Then it represent this meaning:

If there is no data since the last char received during the past 10ms, the current data will be send to remote server.

If the currently received data length exceed 512 byte, then the module will pack all the 512 byte and send to remote server.

The pack mechanism would be triggered if there is either 1 condition meet them.

If we set packet time and packet length to 0, then the module would use a mechanism of auto-packet, which have 4-byte-time packet time, and 1460 byte packet length(available only when firmware revision >= 3006).

6.5. Sync baud via net(2217)

This is a function similiar to RFC2217(but different protocol), which can modify the device's comm parameters via ethernet(tcp or udp connection).

This option is checked by default.

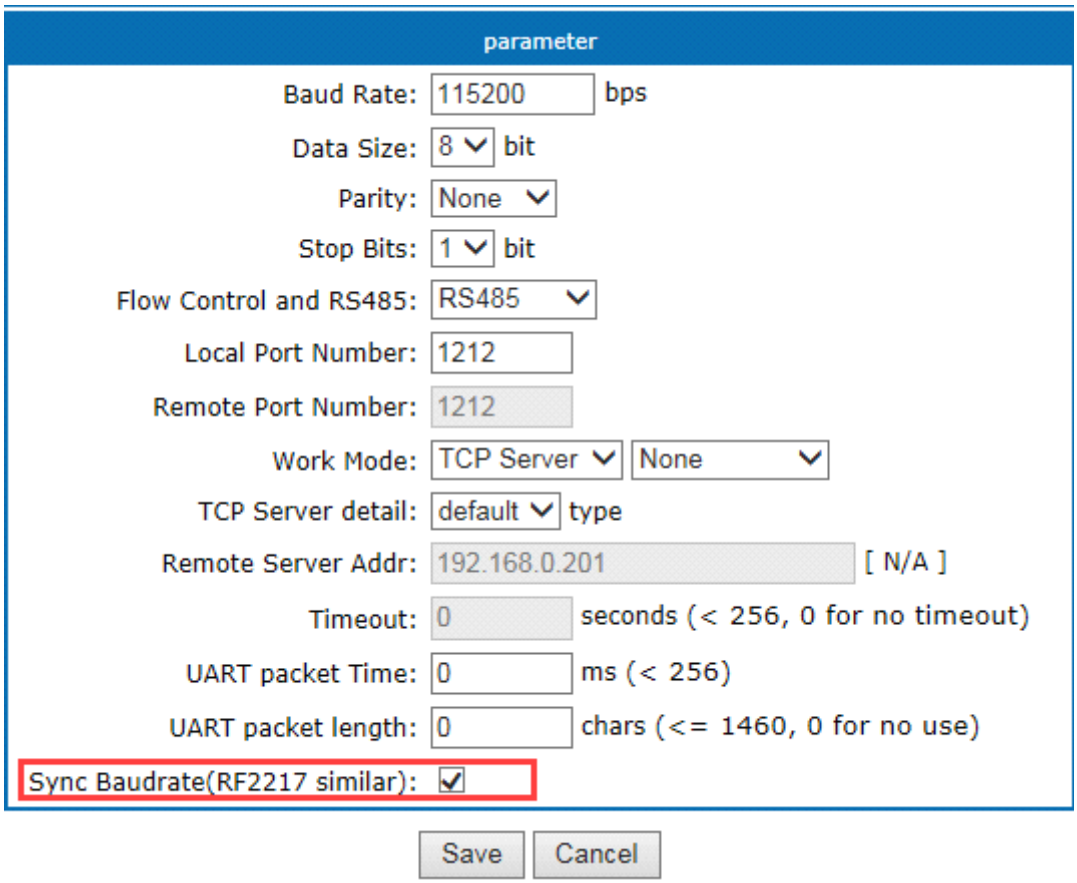

parameter
Baud Rate: 115200 bps
Data Size: 8 bit
Parity: None
Stop Bits: 1 bit
Flow Control and RS485: RS485
Local Port Number: 1212
Remote Port Number: 1212
Work Mode: TCP Server None
TCP Server detail: default type
Remote Server Addr: 192.168.0.201 [N/A]
Timeout: 0 seconds (< 256, 0 for no timeout)
UART packet Time: 0 ms (< 256)
UART packet length: 0 chars (<= 1460, 0 for no use)
Sync Baudrate(RF2217 similar):
Save
Cancel

Diagram 6-5 sync baud

6.6. Webserver port

The module have built-in webserver which allow user to setup parameters via webpage. Default port 80, but we could modify this port according to some special uses.

6.7. Module id and id type

All module have a 2 byte id, default 1; id type default 0

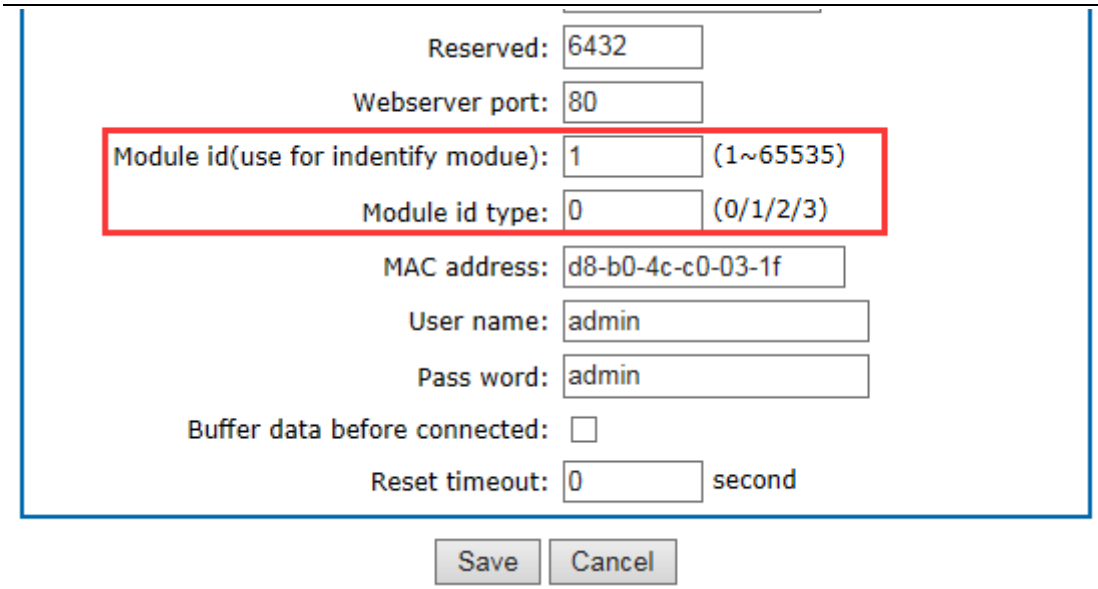


Diagram 6-6 module id and id type

The id type have a mean as below.

ID type	description
0(by default)	No use
1	When module act as client(tcp or udp), after it connect to server, send 4 byte immediately(2 byte Id + 2 byte Id-Complement, 00 01 FF FE by default)；This can be used for USR-D2D service
2	add 4-byte before each frame send to server
3	Both 1 and 2

6.8. Device name

User can modify this name, 15 chars max.

6.9. Buffer data before connected

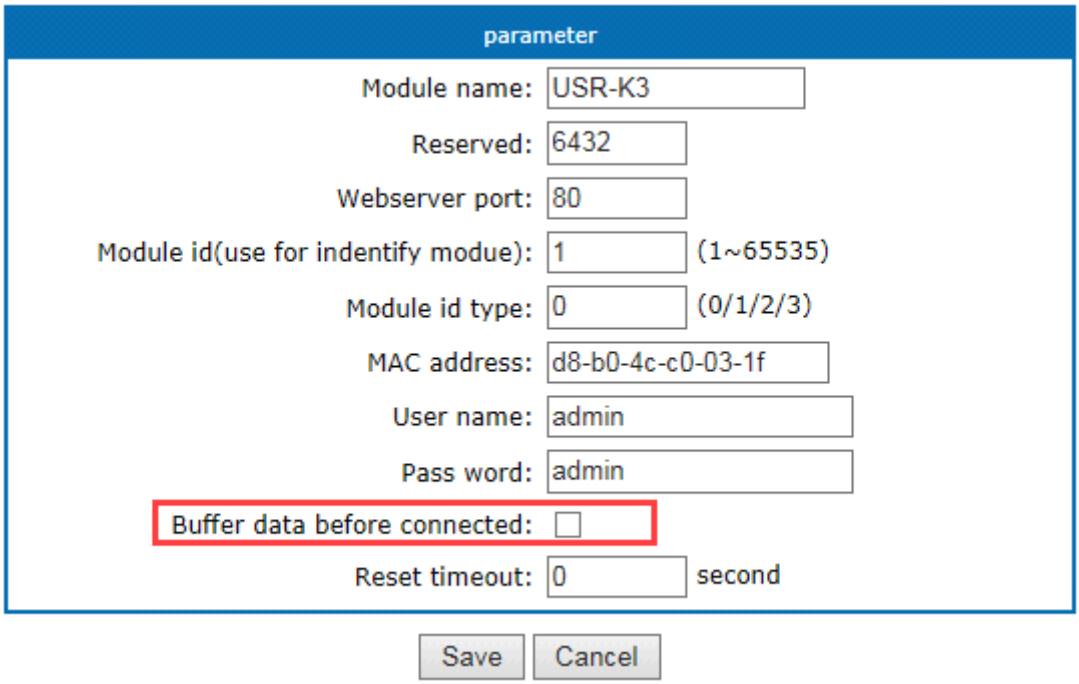


Diagram 6-7 buffer data or not

Default not checked. That is before TCP connected, all the data comm port previously received , will be flushed.

If checked, all the data comm port previously received would be saved and send to server after connected.

6.10. Reset timeout

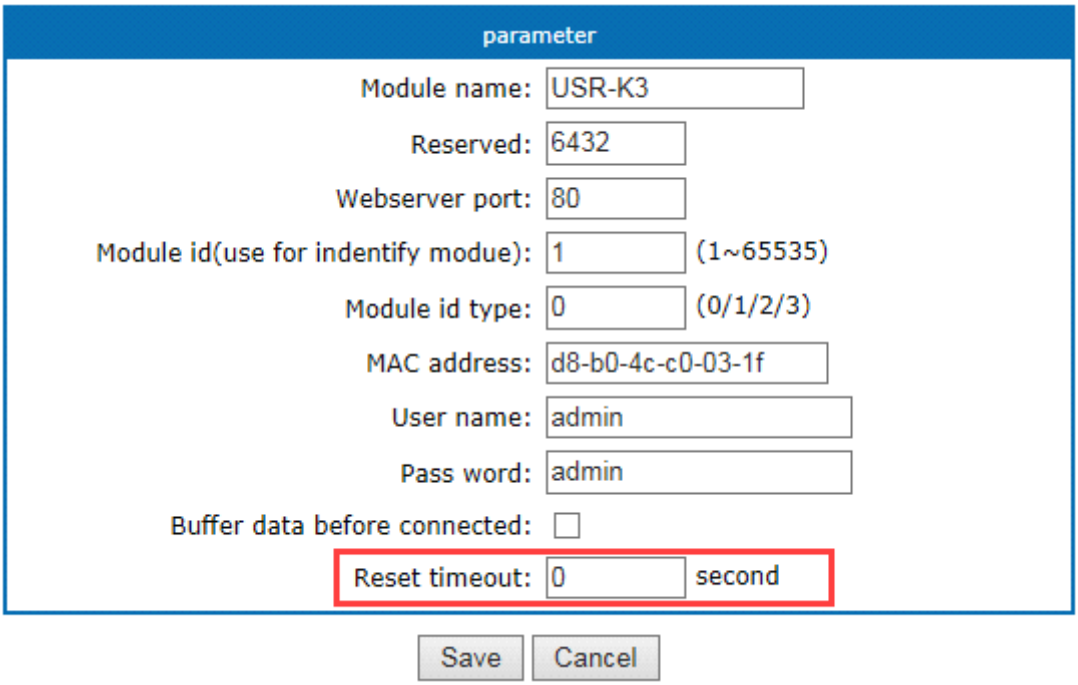


Diagram 6-8 Reset timeout

Default 0, unit is second. When this value between 0~60, the reset timeout function would be no use.

When this value is higher than 60, the module will restart if there is no data received during this time.

6.11. Local IP config

There is Static IP and DHCP, Static IP by default.

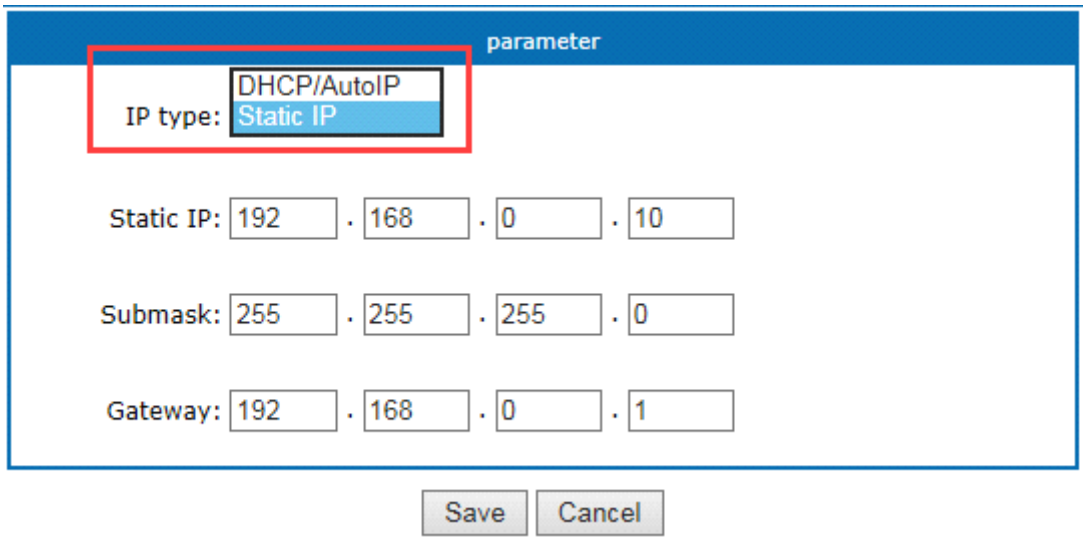


Diagram 6-9 Local IP config

6.11.1. Static IP

Type in the ip address you want to config, such as 192.168.0.10 (192.168.0.7 by default);

Submask usually 255.255.255.0

Gateway usually 192.168.0.1 (your router's ip address)

6.11.2. DHCP

Choose DHCP and save, then reset to take effect. The module will get it's ip address in 5-10seconds, after that you can search for it in the setup software.

6.12. DNS

The module can visit both ip or remote domain name, user can type in the domain name in the IP box. The domain name max length will be 30 chars.

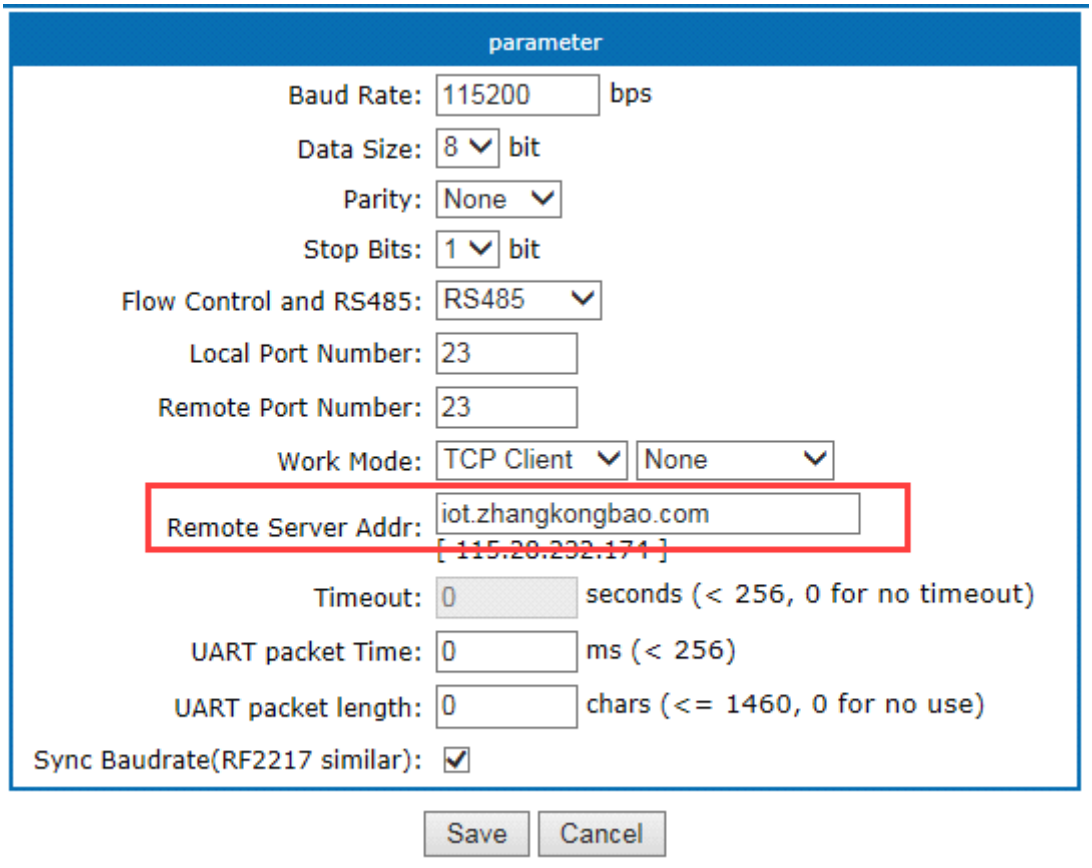

parameter
Baud Rate: 115200 bps
Data Size: 8 bit
Parity: None
Stop Bits: 1 bit
Flow Control and RS485: RS485
Local Port Number: 23
Remote Port Number: 23
Work Mode: TCP Client None
Remote Server Addr: iot.zhangkongbao.com
[115.29.232.174]
Timeout: 0 seconds (< 256, 0 for no timeout)
UART packet Time: 0 ms (< 256)
UART packet length: 0 chars (<= 1460, 0 for no use)
Sync Baudrate(RF2217 similar):
Save
Cancel

Diagram 6-10 domain name or IP

6.13. Comm param

The baud ranges from 600bps to 1024kbps, user can define this to any value.

For the serial device server of RS232 interface, such as TCP232-410, the RS232 interface can only up to 115200bps.

Databit range 5, 6, 7, 8;

Paritybit range None, Odd, Even, Mark, Space

Stopbit range 1, 2

1.1. Username and password

Default both "admin", max 5 chars.

6.14. Firmware revision

USR-K3 的固件版本从 V3000 开始递增。版本可以在网页的左上方看到，或者是在搜索软件上看到。

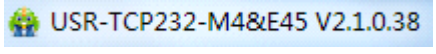
Diagram 6-11 Firmware revision

6.15. RS485

The module's RTS pin, is configured as 485_EN pin, by default.

If you want to extend a RS485 interaface for TCP232-E or TCP232-ED2, you can connect this RTS pin to the 485 IC's enable pin.

6.16. Firmupdate

Use search and config software 

to update firmware, there is a few point need be be attention

- Asking for the firmware from us

- only one module for one time, can not cross network segment.
- You must connect module directly with your PC with a single net cable, and set your PC with a static IP in same segment with module

1. Search and select one module

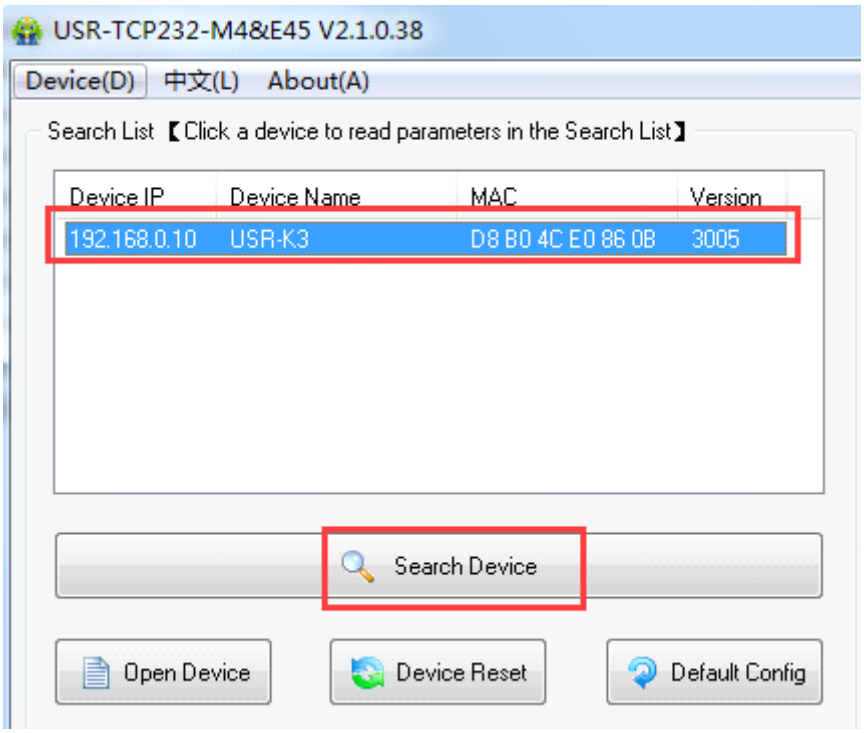


Diagram 6-12 search and select

2. 'Device' -> firmware update

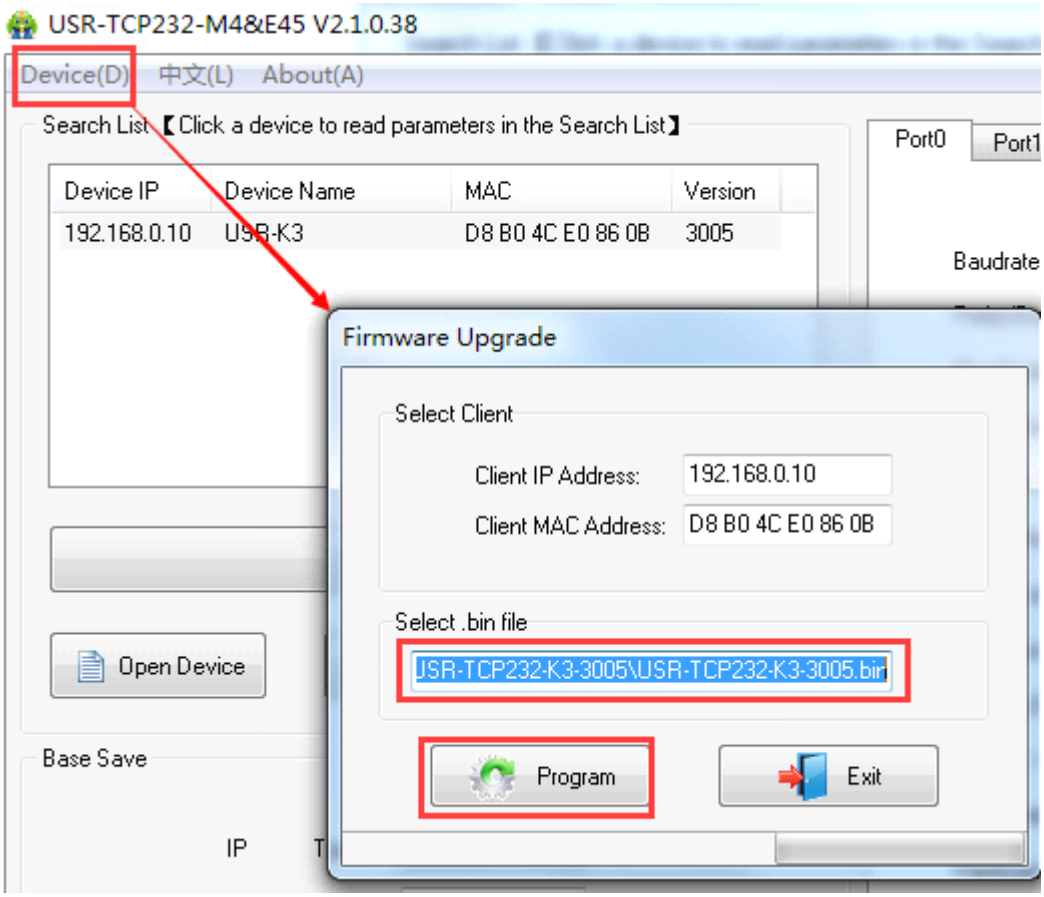


Diagram 6-13 firmware update

Click

to start update progress. If you see a progress bar, means it have started to update.

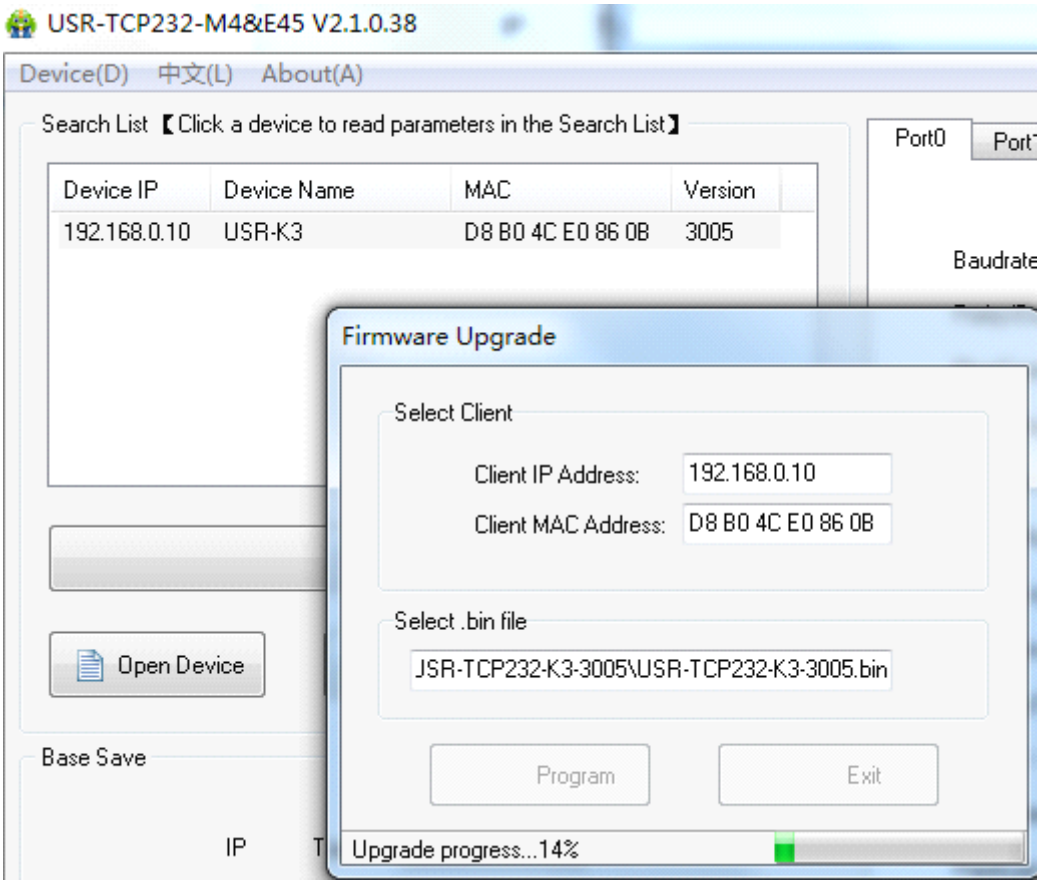


Diagram 6-14 in update progress

3. When it approaches 100%, Update success, click exit.

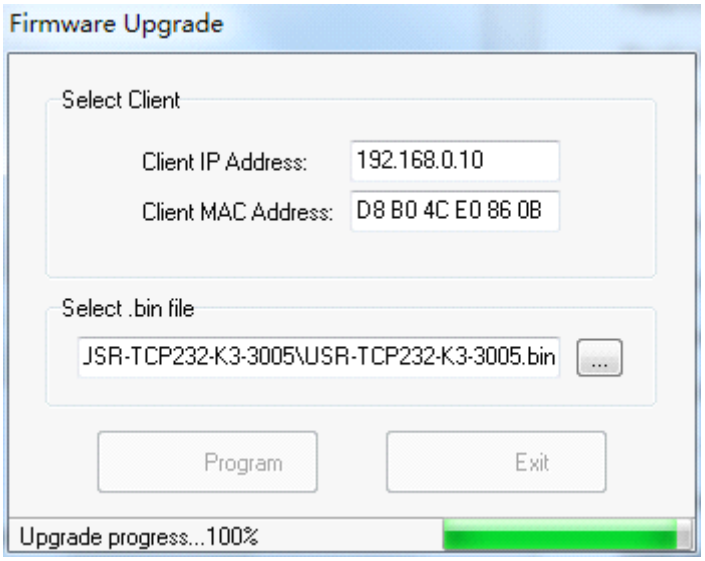


Diagram 6-15 success

Note. After update, if can not search module, restore to factory will fix this problem.

6.17. Common questions

6.17.1. Work across network segment

If your TCP232 device's IP is 192.168.0.7, and remote PC's IP is 192.168.1.7, we need to config.

Subnet mask of TCP232 device, PC, and router to 255.255.0.0, if not ,the TCP232 module will not communicate normally.

6.17.2. Ping is OK but can not open web pages

Some possible causes

1. Module is set a static ip and conflicts with another ethernet device.
2. Cross network and false subnet mask .
3. HTTP server port is modified(default 80).

Solutions:

1. Set another static or use DHCP.
2. Set correct subnet mask.
3. Set this port to 80 or open web page with correct port.

6.17.3. After firm update, can not open web page

Reload this module back to factory settings.

6.17.4. When connection established, server received serval chars

Possible causes.

1) Module id type is not 0.

Solutions.

1) Module id type set 0.

6.17.5. Every serval seconds, module reconnect

Maybe there is a network device which is same ip to module, pls check if ip conflict.

7. Contact us

Company: Jinan USR IOT Technology Co., Ltd

Address: 1-724--728, Huizhan Guoji Cheng, Gaoxin Qu, Jinan, Shandong, China

Tel: 86-531-55507297 86-531-88826739-803

Web: http://en.usr.cn

Skype: lisausr

Support: **http://h.usriot.com/index.php?c=frontTicket&m=sign**

Email: sales@usr.cn tec@usr.cn

8. Modified history

1) V1.0.1 doc established by Huibin Li
2) V1.0.3 correct website link and picture mistake
3) V1.0.5 add support center website
4) V1.0.6 update pin definition picture for K3
5) V1.0.7 add reset timeout and buffer data